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Preliminary Tank Characterization Report for Single-Shell Tank 241-TX-118: Best-Basis Inventory

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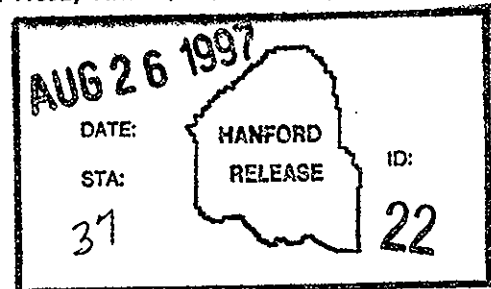
Abstract: An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities. As part of this effort, an evaluation of available information for single-shell tank 241-TX-118 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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Revision 0

**PRELIMINARY TANK
CHARACTERIZATION REPORT
FOR SINGLE-SHELL TANK
241-TX-118:
BEST-BASIS INVENTORY**

July 1997

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**PRELIMINARY TANK CHARACTERIZATION REPORT
FOR SINGLE-SHELL TANK 241-TX-118:
BEST-BASIS INVENTORY**

This document is a preliminary Tank Characterization Report (TCR). It only contains the current best-basis inventory (Appendix D) for single-shell tank 241-TX-118. No TCRs have been previously issued for this tank, and current core sample analyses are not available. The best-basis inventory, therefore, is based on an engineering assessment of waste type, process flow sheet data, early sample data, and/or other available information.

The *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes* (Kupfer et al. 1997) describes standard methodology used to derive the tank-by-tank best-basis inventories. This preliminary TCR will be updated using this same methodology when additional data on tank contents become available.

REFERENCE

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, B. C. Simpson, and R. A. Watrous (LMHC), S. L. Lambert, and D. E. Place (SESC), R. M. Orme (NHC), G. L. Borsheim (Borsheim Associates), N. G. Colton (PNNL), M. D. LeClair (SAIC), R. T. Winward (Meier Associates), and W. W. Schulz (W²S Corporation), 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TX-118

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APPENDIX D**EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR
SINGLE-SHELL TANK 241-TX-118**

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for single-shell tank 241-TX-118 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available chemical and radiological inventory estimates for tank 241-TX-118 consist only of the inventory estimate generated by the Hanford Defined Waste (HDW) model (Agnew et al. 1997a). No TCR has been issued for this tank, and current core sample analyses are not available. The best-basis inventory, therefore, is based on the waste types contained in tank 241-TX-118 and composition data from other Hanford tanks containing similar waste types.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The tank 241-TX-118 chemical and radionuclide inventory predicted by the HDW model (Agnew et al. 1997a) is provided in Table D2-1. The chemical species are reported without charge designation per the best-basis inventory convention.

Table D2-1. Hanford Defined Waste Model Prediction of Tank 241-TX-118 Inventory.

Analyte	Hanford Defined Waste model Inventory ^a (kg)
Al	62,200
Bi	235
Ca	3,150
Cl	4,100
CO ₃	16,400
Cr	3,040
F	766
Fe	14,300
Hg	0.966
K	1,150
La	1.48
Mn	76.8
Na	152,000
Ni	1,030
NO ₂	45,400
NO ₃	167,000
OH	165,000
Pb	96.1
PO ₄	7,110
Si	941
SO ₄	10,800
Sr	0
TOC	4,950
U	1,420
Zr	15.3
Radionuclide	Curies
⁹⁰ Sr	48,400
¹³⁷ Cs	125,000
²³⁹ Pu	4,130
²⁴⁰ Pu	1,030

^aAgnew et al. (1997a), radionuclides decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

D3.1 CONTRIBUTING WASTE TYPES

The HDW model (Agnew et al. 1997a), the Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995), and the waste tank summary report (Hanlon 1997) are not entirely consistent as to the waste types present in tank 241-TX-118 or the total waste volume. The HDW model includes a sludge layer that is not addressed by the other documents and is based on a total waste volume of 235 kL (62 kgal) less than Hanlon (1997).

The HDW model (Agnew et al. 1997a) predicts that the tank contains 23 kL (6 kgal) of evaporator concentrates from the 242-T Evaporator (1951-1955) (T1 salt cake), 908 kL (240 kgal) of evaporator concentrates from the 242-T Evaporator (1965-1976), (T2 salt cake), with compositions derived from the Supernatant Mixing Model (SMM), and 148 kL (39 kgal) of sludge from Z Plant waste. The total waste volume predicted by the HDW waste is 1,097 kL (285 kgal).

The SORWT model (Hill et al. 1995) lists evaporator bottoms, cladding waste, and partially neutralized evaporator feed as the primary, secondary, and tertiary waste types, respectively, in this tank. No tank-specific quantitative information is given in this report for waste types. Hanlon (1997) indicates the entire tank inventory (1,313 kL [347 kgal]) is salt cake. Since one of the HDW model's purposes was to predict waste layers for the tanks from waste transfer records, the assessment from Agnew et al. (1997a) will be used for this report.

D3.2 EVALUATION OF TECHNICAL FLOWSHEET INFORMATION

Waste transaction records (Agnew et al. 1997b, Anderson 1990) show tank 241-TX-118 received evaporator feed from various T, TX, TY, and U tanks from the second quarter of 1951 to the third quarter of 1955. At that time, 265 kL (70 kgal) was left in the tank. The tank received decontamination waste from U and T Plants from the fourth quarter of 1957 to the third quarter of 1965. At that point the waste level was at 2,680 kL (708 kgal) with 30.3 kL (8 kgal) of solids. Tank 241-TX-118 was the feed tank for the 242-T Evaporator throughout the evaporator's operating lifetime. The feed for the early period was first decontamination cycle of the bismuth phosphate process (1C) supernatant, concentrated in two passes, and later uranium recovery waste supernatant.

From the fourth quarter of 1965 to the second quarter of 1973, the tank received evaporator feed from various tanks. The lowest level reached during this period was 1,320 kL (349 kgal) and the level at the end of this period was 2,360 kL (623 kgal). In the second quarter of 1973, periodic Z Plant waste additions began. Waste transaction records (Agnew et al. 1997b) indicate the tank received Z Plant and evaporator feed additions from the second quarter of 1973 to the second quarter of 1976. The lowest level reached during

this period was 1,780 kL (469 kgal), and the level at the end of this period was 2,070 kL (547 kgal).

From the second quarter of 1976 to the second quarter of 1980, the tank received evaporator feed from various tanks. The lowest level reached during this period was 1,340 kL (354 kgal), and at the end of the period the level was 2,360 kL (642 kgal). From the third quarter of 1980 to the fourth quarter of 1982, there were transfers to tank 241-SY-102. At the end of this period the waste level was reduced to 1,080 kL (285 kgal), according to Agnew et al. (1997b).

D3.3 DETERMINATION OF WASTE VOLUMES

Hanlon (1997) reports a total waste volume of 1,314 kL (347 kgal). This volume was based on a level measurement taken on November 17, 1980. Discrepancies between Hanlon (1997) and Agnew et al. (1997a) have been observed and evaluated. The waste volume in tank 241-TX-118 was reduced by salt well pumping (337 kL [89.1 kgal]) in 1982. The HDW model uses a total waste volume of 1,079 kL (285 kgal) based on 111.2 in. of waste reported in Husa et al. (1993). However, Husa actually reports the waste level to be 117.7 in. in "intrusion mode." In "intrusion mode," the level sensing device is set less than 1 in. above the surface; therefore, 116.7 in. (1,137 kL [300.4 kgal]) should be the correct level and is used for this report. Anderson (1990) reports the solids volume as 30 kL (8 kgal) for the first quarter of 1965 and 19 kL (5 kgal) for the third quarter of 1966, so the HDW model solids volume is reasonable.

The HDW model estimate of the T1 salt cake volume is based on a solids volume measurement made in the third quarter of 1957 (23 kL [6 kgal]). A total of 360 kL (95 kgal) of 242-T Evaporator bottoms was stored in tank 241-TX-118 for several years, which is sufficient to have produced the observed volume of T1 SlkCk.

Agnew et al. (1997a) reports that 6,900 kL (1,820 kgal) of Z Plant waste was transferred into tank 241-TX-118. However, after examination of Z Plant process records (Smetana 1976 and Reberger 1979), the volume was revised to 5,680 kL (1,500 kgal) (see section D3.4.3 for further discussion). The Z Plant sludge layer volume was correspondingly revised to 131 kL (34.5 kgal) based on the waste being 2.3 volume percent solids (Agnew et al. 1997a).

The T2 salt cake volume of 984 kL (259.9 kgal) was deduced by subtracting the T1 salt cake and Z Plant sludge from the total volume of 1,137 kL (300.4 kgal).

D3.4 COMPOSITION OF TANK 241-TX-118 WASTE

The following are the calculational bases and example calculations for estimating component inventories in tank 241-TX-118.

D3.4.1 Composition of T1 Salt Cake

Operation of the 242-T Evaporator between 1951 and 1955 resulted in 2,903 kL (767 kgal) of salt cake which is contained in 10 underground storage tanks (T, TX, and TY Tank Farms) (Agnew et al. 1997a). The evaporator feeds during this time period consisted largely of 1C and TBP waste supernatants. The HDW model refers to this salt cake as T1 SltCk on a global basis. The HDW model uses this average T1 SltCk composition to calculate the T1 salt cake inventories for individual tanks rather than its SMM, because of the lack of detailed evaporator feed composition data. The salt cake produced by the 242-T Evaporator from 1951 through 1955 is referred to as T1 salt cake hereafter in this report. Seventy-nine percent of the T1 salt cake is contained in the TX Tank Farm. With the exception of tank 241-T-109, all tanks containing T1 salt cake also contain other waste types. Five of the tanks containing T1 salt cake have been core or auger sampled (tanks 241-T-108, 241-T-109, 241-TX-116, 241-TY-101, and 241-TY-102).

The auger samples for tanks 241-T-108 and 241-T-109 are recent (1995), and laboratory analyses should meet all Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) requirements. Tank 241-T-108 is expected to contain 1C/Cladding Waste (1C/CW) sludge as well as T1 salt cake (Agnew et al. 1997a); however, the analytical results indicate that the tank 241-T-108 sample retrieved was primarily salt cake as evidenced by the high sodium concentration (223,000 $\mu\text{g/g}$) reported for the composite sample (Baldwin 1996). Tank 241-T-109 contains only T1 salt cake generated from the 242-T Evaporator concentration of TBP and 1C/CW supernatants. The composition of the tank 241-T-109 salt cake is not typical in that it is primarily sodium phosphate rather than sodium nitrate. The composition reported by the TCRs for tanks 241-T-108 (Baldwin et al. 1996) and 241-T-109 (Brown et al. 1996) are included in Table D3-1.

T1 salt cake was deposited in tank 241-TX-116 between 1951 and 1955. The tank 241-TX-116 core sample was taken with the initial prototype of a rotary core sampler between April 1976 and January 1977 (Allen 1977). Sample recoveries were relatively poor, and no material was recovered from several segments. Additionally, analytical methods and quality assurance differed from current practices. The analytical data are provided in a letter report (Horton 1977). Core segments 6, 7, 9, and 10 are expected to be T1 salt cake, based on the HDW model layer volumes. This is confirmed by differences in the core sample results for segments 6, 7, 9, and 10 as compared to segments 1 through 4 (T2 salt cake). No material was recovered in segments 5 and 8, nor for any segment below segment 10 (the bottom 307 kL [81 kgal] of waste). The analytical results were corrected to a silicon-free basis since diatomaceous earth (92 percent SiO_2) was added to tank 241-TX-116 in November of 1970 (Buckingham and Metz 1974). The analytical results are included in Table D3-1.

Tanks 241-TY-101 and 241-TY-102 were core sampled in 1985. As with the tank 241-TX-116 core sample, the analytical methods and quality assurance differed from current practices. Tank 241-TY-101 contains ferrocyanide scavenging wastes as well as salt cake. The relatively low sodium concentration reported for the composite (121,000 $\mu\text{g/g}$, Weiss and Mauss 1987a) indicates the sample was primarily sludge, and the data are not usable as

an example of T1 salt cake. Tank 241-TY-102 contains both T1 and T2 salt cakes (about 39 percent T1 salt cake). Since only composite analyses were performed, the data are not appropriate examples of T1 salt cake.

However, it should be noted that the phosphate concentration for tank 241-TY-102 is relatively low (29,000 $\mu\text{g/g}$, Weiss and Mauss 1987b), indicating that the phosphate concentration of the T1 salt cake added to tank 241-TY-102 could not have been comparable to concentrations measured for tanks 241-T-108 and 241-T-109 (125,000 and 246,000 $\mu\text{g/g}$ respectively, Table D3-1). Phosphate concentrations exceeding 100,000 $\mu\text{g/g}$ are not necessarily typical of T1 salt cakes based on the analytical results for tanks 241-TY-102 and 241-TX-116. The reason for this wide variation in phosphate concentration is not known, but supernatants recycled from salt receiving tanks to the 242-T Evaporator might have been depleted in phosphate; and consequently, the salt cakes formed from recycled supernatants would have a lower phosphate concentration.

The mean analytical data for tanks 241-T-108, 241-T-109, and 241-TX-116 are tabulated in Table D3-1. The relative standard deviation of the mean for all components, except sodium and zirconium, are extremely high, indicating that the composition of the waste type is extremely variable. Because of feed staging and waste distribution factor, this degree of variability is not unexpected.

Any model which assumes that T1 salt cake has a relatively consistent composition, including the prediction in Table D3-1 or the HDW model (Agnew et al. 1997a), will have very limited usefulness in predicting the inventory of a tank containing T1 salt cake. The predicted T1 salt cake composition differs significantly from the HDW model T1 SltCk concentrations for most chemical analytes. Average analyte concentration data from tanks 241-T-108, 241-T-109, and 241-TX-116 will be used to derive a T1 salt cake composition. The global composition of T1 salt cake predicted by the HDW model is included in Table D3-1 for comparison.

Table D3-1. Composition of T1 Salt Cakes (3 Sheets).

Analyte	Tank 241-T-108 ^a ($\mu\text{g/g}$)	Tank 241-T-109 ^b ($\mu\text{g/g}$)	Tank 241-TX-116 ($\mu\text{g/g}$) ^{c,d}	Relative std dev of mean (%)	Average - predicted T1 salt cake ($\mu\text{g/g}$)	HDW model T1 SltCk ^e ($\mu\text{g/g}$)
Ag	<7.96	18.6	NR	NA	<13.3	NR
Al	2,290	1,250	1,720	17.2%	1,750	140.1128
Bi	605	170	NR	56.1%	388	1,806.784
Ca	177	324	NR	29.3%	251	2,116.939
Cd	<7.96	<5	NR	NA	<5 ^f	NR

Table D3-1. Composition of T1 Salt Cakes (3 Sheets).

Analyte	Tank 241-T-108 ^a (μg/g)	Tank 241-T-109 ^b (μg/g)	Tank 241-TX-116 (μg/g) ^{c,d}	Relative std dev of mean (%)	Average - predicted T1 salt cake (μg/g)	HDW model T1 SltCk ^e (μg/g)
Cl	<905	341	NR	NA	341 ^f	1,376.542
CO ₃	NR	10,400	32,800	67.2%	21,600	6,832.004
Cr	19.2	40	150	58.3%	69.9	128.6514
F	10,700	13,000	3,140	33.3%	8,950	948.0084
Fe	6,110	5,490	16,000	37.0%	9,200	4,040.613
Hg	NR	NR	NR	NA	NR	0.601441
K	<239	<500	NR	NA	<239 ^f	270.302
La	<39.8	<50	NR	NA	<39.8 ^f	0
Mn	182	1,030	NR	70.0%	606	0
Na	223,000	181,000	246,600	8.85%	216,900	185,809.8
Ni	<15.9	<20	NR	NA	<18	396.1703
NO ₂	6,210	492	210	84.8%	2,300	5,525.867
NO ₃	392,000	20,800	574,700	49.5%	329,200	333,726.3
OH	NR	NR	NR	NA	NR	8,933.119
Pb	533	303	NR	27.5%	418	0
P as PO ₄	125,000	246,000	13,500	52.4%	128,200	70,614.37
Si	1,500	889	NA	25.6%	1,200	287.0366
S as SO ₄	1,110	516	34,200	93.2%	11,900	5,974.895
Sr	21.6	<10	NR	NA	<15.8	0
TOC	NR	NR	NR	NA	NR	1.34 E-06 (wt%)
U	1,130	<500	0.0052	NA	<543	9,724.072
Zr	10.9	12.2	NR	5.63%	11.6	19.18255

Table D3-1. Composition of T1 Salt Cakes (3 Sheets).

Analyte	Tank 241-T-108 ^a ($\mu\text{g/g}$)	Tank 241-T-109 ^b ($\mu\text{g/g}$)	Tank 241-TX-116 ($\mu\text{g/g}$) ^{c,d}	Relative std dev of mean (%)	Average - predicted T1 salt cake ($\mu\text{g/g}$)	HDW model T1 SlitCk ^e ($\mu\text{g/g}$)
Radio- nuclide	$\mu\text{Ci/g}$	$\mu\text{Ci/g}$	$\mu\text{Ci/g}$	%	$\mu\text{Ci/g}$	$\mu\text{Ci/g}$
²⁴¹ Am	<0.123	NR	NR	NA	<0.123 ^g	4.67 E-04
⁶⁰ Co	<0.0133	NR	NR	NA	<0.0162 ^g	5.77 E-05
¹³⁴ Cs	NR	NR	2.44	NA	0.0080 ^g	2.43 E-06
¹³⁷ Cs	2.00	NR	4.74	40.7%	2.63 ^g	34.44064
¹⁵⁴ Eu	<0.0455	NR	NR	NA	<0.0514 ^g	0.001026
¹⁵⁵ Eu	<0.0407	NR	NR	NA	<0.0503 ^g	0.004959
Density (g/mL)	2.35	1.55 ^h	NR	NA	1.95	1.742038
% H ₂ O	19.5%	47.70%	NR	NA	33.6%	37.7268%

HDW = Hanford Defined Waste

NA = Not applicable

NR = Not reported

^a Baldwin et al. (1996)

^b Brown et al. (1996)

^c Horton (1977)

^d Silica-free basis due to the addition of diatomaceous earth to this tank

^e Agnew et al. (1997a)

^f Since these analytes were not expected in this waste, the lower value was used instead of an average

^g Predicted T1 salt cake radionuclides are decayed to January 1, 1994. The radionuclides for tanks 241-T-108, 241-T-109, and 241-TX-116 are reported as of the date analyzed, therefore, the average predicted values may not match the reported values

^h The density reported by the 241-T-109 TCR (Brown et al. 1996) was not actually measured, but based on a HDW model Rev. 3 estimate (Agnew et al. 1996).

The density for tank 241-T-108 (2.35 g/mL) is higher than expected and reflects a laboratory particle density measurement rather than a bulk density determination. The density of the predicted T1 salt cake was somewhat arbitrarily set at 1.7 g/mL to avoid over

reporting of the tank inventory. The selected value is in good agreement with the HDW model prediction for T1 salt cake.

The weight percent water reported for the T1 salt cake layer in tank 241-TX-116 is quite low (7.4 wt%). The result may reflect either sample dry out or the in-tank effects of the diatomaceous earth addition. No adjustments were made to the weight percent water or the reported analyte concentrations for T1 salt cake.

D3.4.2 Composition of 242-T Salt Cake

Post-1965 operation of the 242-T Evaporator resulted in 22,672 kL (5,990 kgal) of salt cake that is contained in 26 underground storage tanks in the S, SX, U, T, TX, and TY tank farms (Agnew et al. 1997a). The salt cake produced by the 242-T Evaporator during the time period of 1965 to 1976 is referred to as T2 salt cake. The HDW model refers to this salt cake as T2 SltCk on a global basis or as SMMT2 when calculated by the Supernatant Mixing Model (SMM) for an individual tank. Ninety-one percent of the T2 SltCk is contained in the TX tank farm. All tanks containing T2 SltCk also contain other waste types.

Eight tanks containing T2 SltCk have been core sampled and analyzed, 241-S-107, 241-U-102, 241-U-105, 241-U-107, 241-TX-107, 241-TX-116, 241-TY-102, and 241-TY-103. Only three of these tanks (241-U-102, 241-U-105 and 241-TX-116) have analytical data available at the segment level and T2 SltCk layers large enough with sufficiently detailed data to differentiate it from other waste types in core sample data.

T2 salt cake was formed in tanks 241-U-102 and 241-U-105 in 1975 and 1976. Core sampling of tanks 241-U-102 and 241-U-105 was performed in early 1996. Based on the HDW model, Segments 4, 5 and 6 from the two cores from tank 241-U-102 and Segment 8 of two cores from tank 241-U-105 are expected to be representative of the T2 SltCk waste type. An independent determination of these levels is not possible because of a lack of solids volume measurements in this time period. A significant composition change between the evaporator concentrates from 242-S Evaporator (1973-1976) (S2 salt cake) and T2 SltCk layers cannot be seen in the core sample data. The recent analytical data from these tanks should meet all *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1994) requirements. Descriptions of the core sampling events and analytical data are available in the respective TCRs (Hu et al. 1997 and Brown and Franklin 1996).

T2 salt cake was deposited in tank 241-TX-116 between 1966 and 1971. The tank 241-TX-116 core sample was taken with the initial prototype of a rotary core sampler in 1976 to 1977. Sample recoveries were relatively poor (Allen 1977). Additionally, analytical methods and quality assurance differed significantly from current practices. However, this sample event provides the only composition data for early production of the T2 SltCk waste type. Inclusion of an early T2 SltCk type is important since 242-T Evaporator feeds and

operating practices changed over time. The analytical data are provided in a letter report (Horton 1977).

Core segments 1 through 4 are expected to be representative T2 SltCk from the HDW model, and this is confirmed by vertical differences in the core sample results. It was necessary to correct the analytical results to a silica-free basis since diatomaceous earth (92 percent SiO_2) had been added to tank 241-TX-116. The silica from the diatomaceous earth had migrated into the top four core segments (approximately 203.2 cm [80 in.]) of the salt cake.

The composition data for tanks 241-U-102, 241-U-105, and 241-TX-116 are summarized in Table D3-2. The analytical results for tanks 241-U-102 and 241-U-105 were averaged based on the mass of each partial core segment analyzed (as opposed to simple arithmetic averaging of the analytical results) because the core segments were not of equal length nor were the partial core segments of equal mass. Similarly, a weighted average was created for the combination of the two U farm tanks.

The analytical results for tank 241-TX-116 core segments were simply averaged since the core segments were of equal length. The T2 SltCk prediction is the arithmetic average of the average U Farm and 241-TX-116 concentrations. The data for tank 241-TX-116 were intentionally given more emphasis in the generalized T2 SltCk prediction (50 percent of the predicted concentration) as it represents an operating period that is more applicable to the TX Tank Farm. The global HDW model composition for T2 SltCk is included in the Table D3-2 for comparison.

Table D3-2. Composition of T2 Salt Cakes (2 Sheets).

Analyte	241-U-102 T2 salt cake wt. avg. ^{a,b} (μg/g)	241-U-105 T2 salt cake wt. avg. ^{a,c} (μg/g)	U Tank Farm T2 salt cake wt. avg. ^a (μg/g)	241-TX-116 T2 salt cake mean ^{d,e} (μg/g)	T2 salt cake prediction ^f (μg/g)	HDW T2 SltCk ^g (μg/g)
Ag	11.6	19.7	13.1	NR	13.1	NR
Al	18,000	12,900	17,100	38,000	27,500	17,912
Bi	<70.5	<47.2	<66.2	NR	<66.2	220.81
Ca	308	253	298	NR	298	1,462
Cd	<5.94	12.8	<7.21	NR	<7.21	NR
Cl	5,100	5,790	5,230	NR	5,230	3,327.8
CO ₃	53,500	36,500	50,300	58,000	54,200	17,093
Cr	2,310	2,100	2,270	353	1,310	4259.6
F	<125	1,110	<307	3,540	<1,920	930.79
Fe	391	2,270	737	23,900	12,300	620.58
Hg	NR	NR	NA	NR	NA	1.1338
K	1750	1,470	1,700	NR	1,700	1060.7
La	<35.2	29.7	<34.2	NR	<34.2	1.0 E-04
Mn	123	743	237	NR	237	160.31
Na	262,600	220,500	254,800	166,700	210,800	192,764
Ni	91.5	89.5	91.1	NR	91.1	405.82
NO ₂	56,700	40,100	53,600	7,840	30,700	46,096
NO ₃	284,700	395,700	305,200	308,700	306,946	268,197
OH	NR	NR	NA	NA	NA	68,079
Pb	<119	214	<136	NR	<136	109.91
P as PO ₄	5,050	14,100	6,720	8,620	7,670	7,707.9
Si	152	232	167	NR	167	1,817.7
S as SO ₄	17,900	8,350	16,200	16,400	16,300	13,823
Sr	<7.04	<4.72	<6.61	NR	<6.61	0
TOC	8,810	11,000	9,210	NR	9,210	5,191
U	<353	545	<388	NR	<388	2,174.3
Zr	10.8	45.4	17.2	NR	17.2	14.707

Table D3-2. Composition of T2 Salt Cakes (2 Sheets).

Analyte	241-U-102 T2 salt cake wt. avg. ^{a,b} (μg/g)	241-U-105 T2 salt cake wt. avg. ^{a,c} (μg/g)	U Tank Farm T2 salt cake wt. avg. ^a (μg/g)	241-TX-116 T2 salt cake mean ^{d,e} (μg/g)	T2 salt cake prediction ^f (μg/g)	HDW T2 SltCk ^g (μg/g)
Radionuclide ^h (μCi/g)						
²⁴¹ Am	<37.0	<0.95	<30.3	NR	<30.3	0.0285
⁶⁰ Co	<0.155	0.086	<0.142	NR	<0.142	0.027
¹³⁴ Cs	NR	NR	NA	9.64 E-04	9.64 E-04	0.0016
¹³⁷ Cs	197	145	188	34.8	111	163.24
¹⁵⁴ Eu	<0.475	0.61	<0.499	NR	<0.499	0.431
¹⁵⁵ Eu	<1.10	0.82	<1.05	NR	<1.05	0.1849
Density (g/mL)	1.66	1.73	1.70 ⁱ	NR	1.70	1.634

HDW = Hanford Defined Waste

NA = Not applicable

NR = Not reported

^a Weighted average based on the weight of each partial core segment analyzed^b Hu et al. (1997)^c Brown and Franklin (1996)^d Silica-free basis due to the addition of diatomaceous earth to this tank^e Horton (1977)^f Average of U Tank Farm and tank 241-TX-116 data^g Agnew et al. (1997)^h Decayed to January 1, 1994ⁱ A simple average is used for the density.

The use of the 241-U-102, 241-U-105, and 241-TX-116 composition data to represent the composition of other T2 salt cakes should be viewed only as an approximation. None of these three tanks had undergone salt well pumping at the time of the respective core samples. In the case of tank 241-TX-118, these data are being applied to a salt cake that has been salt well pumped and has collapsed to a reduced volume as the result of the removal of interstitial liquid. Additionally, the T2 SltCk projected by the HDW model in tanks 241-U-102 and 241-U-105 could be erroneous if the transfers were TX farm supernatants (i.e., saturated salt solutions that had already cooled and would not form additional salt cake) rather than actual evaporator bottoms.

D3.4.3 Composition of Z Plant Sludge

Z Plant acid wastes were transferred to the 242-T Evaporator Building for neutralization with the caustic contained in tank waste supernatants between May 1973 and November 1980 (Flesher 1982). The Z plant acid wastes contained significant concentrations of sodium, aluminum, iron, calcium, magnesium, and plutonium. Neutralization of the Z Plant acid wastes resulted in the precipitation of a significant volume of sludge.

The Z Plant wastes were transferred in small batches (< 15 kL [4 kgal]) to a holding tank in the 242-T Evaporator Building and flow-blended with evaporator feed material from tank 241-TX-118 at a ratio of 20-30 volumes of tank waste supernatants per volume of Z Plant acid waste. The chemicals/radionuclides contained in the Z Plant acid wastes would be included in the transfer to the evaporator bottoms tank if the 242-T Evaporator was operating at the time. If the 242-T Evaporator was not operating, the neutralized Z Plant waste was recycled to tank 241-TX-118.

The fraction of Z Plant acid waste routed to evaporator bottoms tanks, rather than tank 241-TX-118, is unknown. However, the bulk of this material is thought to have been routed to tank 241-TX-118 (Flesher 1982). This evaluation will assign all solid material resulting from the neutralization of Z Plant acid wastes to tank 241-TX-118. This is consistent with the assumptions made by the HDW model (Agnew et al. 1997a), and represents a conservative assumption regarding its distribution.

Waste transaction records (Agnew et al. 1997b) indicate the transfer of 6,900 kL (1,823 kgal) of Z Plant acid wastes to the 242-T Evaporator between the second quarter of 1973 and the second quarter of 1976. The transfer volumes are identical to those reported by Anderson (1990), with the exception of additional transfer data provided for the second quarter of 1976 (not reported by Anderson 1990). Graphs of the Z Plant waste volumes transferred during 1973 to 1976 are also contained in ARH-CD-323 (Smetana 1976). The reported Z Plant waste transfers are summarized in Table D3-3.

The Z Plant waste volume transferred to the 242-T Evaporator in the first quarter of 1974 is reported as 2,354 kL (622 kgal) by both Agnew et al. (1997b) and Anderson (1990). This volume appears to be in error since it is 2.5 times the next highest total reported for the 1973 to 1976 time period and occurred after shutdown of the Z Plant remote mechanical C-line oxide line. Only the Plutonium Reclamation Facility [PRF] was operating. ARH-CD-323 (Smetana 1976) indicates that the Z Plant waste volume transferred during the first quarter of 1974 was only 241 kL (64 kgal). It will be assumed that a transcription error occurred, and the correct transaction volume is 235 kL (62.2 kgal). This reduces the Z Plant acid waste transferred to the 242-T Evaporator by 2,120 kL (560 kgal).

Table D3-3. Z Plant Acid Waste Transfers to the 242-T Evaporator Facility.

Year	Quarter	WSTRS volume transferred ^a (kgal)	ARH-CD-323 volume transferred ^b (kgal)	Comment
1973	2nd Quarter	148	114	
	3rd Quarter	247	306	
	4th Quarter	86	88	
1974	1st Quarter	622	64	WSTRS/Anderson 1990 in error - assumed 62.2 kgal
	2nd Quarter	138	149	
	3rd Quarter	73	78	
	4th Quarter	93	87	
1975	1st Quarter	56	51	
	2nd Quarter	97	92	
	3rd Quarter	79	91	
	4th Quarter	75	60	
1976	1st Quarter	48	47	
	2nd Quarter	61	NR	Not reported by Anderson 1990 or Smetana 1976
Subtotal		1,823	1,224	
Correction for 1st Quarter of 1974		- 560	NA	
Estimated 1976-1980		+ 237	+ 298	
Adjusted Total		1,500	1,522	

NA = not applicable

NR = not reported

WSTRS = Waste Status and Transaction Record Summary

^aAgnew et al. (1997b)^bSmetana (1976).

The 242-T Evaporator was shut down in April 1976; however, neutralization of the Z Plant acid wastes at the 242-T Evaporator facility continued until November 1980 (Fletcher 1982). All transfers after shutdown of the 242-T Evaporator were routed to tank

241-TX-118. The only significant Z Plant operations during this time period consisted of a PRF clean out campaign conducted from April 1978 to February 1979 (Reberger 1979). Waste transactions for the waste associated with the PRF clean out campaign were not included in the waste transaction records (Agnew et al. 1997b).

The waste volume transferred during the 1978 to 1979 PRF campaign can be estimated from the PRF operation time of ten months and the average monthly Z Plant waste transfers (89.7 kL/month [23.7 kgal/month]) for January 1975 through March 1976. The resulting volume increase in the Z Plant acid waste is 897 kL (237 kgal).

As a result of the previous discussion, the total Z Plant waste sent to tank 241-TX-118 is revised from 6,900 kL (1,823 kgal) to 5,678 (1,500 kgal) (see Table D3-3). The estimated Z Plant waste sludge layer in tank 241-TX-118 is correspondingly revised to 131 kL (34.5 kgal) based on 2.3 vol% solids (Agnew et al. 1997a).

The HDW model basis for the Z Plant waste composition is not stated (Agnew et al. 1997a); however, the chemical concentrations are similar to those reported by Lucas (1989) and the SORWT model (Hill et al. 1995). The HDW model composition includes corrosion products and other elements which it estimates on a global basis and apportions between the various HDW. The HDW model incorrectly assumes that Z Plant acid wastes were neutralized with sodium hydroxide before transfer from Z Plant to tank 241-TX-118; however, this additional sodium hydroxide would not be expected to significantly alter the composition of the precipitated sludge. The HDW model chemical concentrations for the Z Plant waste is the best estimate that is currently available.

The HDW model document (Agnew et al. 1997a) indicates that Z Plant waste plutonium concentration is based on assumed tank 241-SY-102 plutonium inventory of 50 kg. This corresponds to approximately 20 μCi of $^{239/240}\text{Pu}$ per gram of sludge.

Attempts to independently calculate a Z Plant sludge plutonium concentration from the 1988 and 1990 core sample analyses of tank 241-SY-102 were unsuccessful. The sample most closely representing Z Plant sludge is the top sludge segment in the 1988 core sample (designated as 102-SY-3C, Winters et al. 1995). The $^{239/240}\text{Pu}$ concentration of the Z Plant waste predicted by the HDW model will be used for inventory calculations.

Additionally, tank 241-SY-102 did not receive Z Plant waste until 1982. The plutonium concentration of the Z Plant waste sent to tank 241-TX-118 from 1973 to 1980 may have been quite different because of changes in plant operations and process flowsheets. The HDW model plutonium concentration for the Z Plant wastes should be regarded as only a very rough estimate.

The chemical and radionuclide inventory for the Z Plant sludge layer was recalculated using HDW model sludge composition and the revised sludge volume of 131 kL (34.5 kgal). The results are provided in Table D3-4. The sludge is actually distributed in the upper salt cake layer in tank 241-TX-118 and is not present as a discrete layer.

Table D3-4. Estimated Composition of Z Plant Sludge. (2 Sheets)

Analyte	HDW Z Plant Sludge ($\mu\text{g/g}$)	HDW Z Plant Sludge ^a (kg)
Al	172,400	38,800
Bi	0	0
Ca	9,610	2,160
Cl	1,020	229
CO ₃	17,900	4,030
Cr	158	35.4
F	0	0
Fe	54,600	12,300
Hg	0	0
K	159	35.8
La	0	0
Mn	0	0
Na	26,300	5,910
Ni	3,320	747
NO ₂	208	46.7
NO ₃	51,300	11,600
OH	381,000	85,600
Pb	0	0
PO ₄	4.29	0.964
Si	0	0
SO ₄	211	47.4
Sr	0	0
TOC	0	0
U	0	0
Zr	0	0

Table D3-4. Estimated Composition of Z Plant Sludge. (2 Sheets)

Analyte	HDW Z Plant Sludge ($\mu\text{g/g}$)	HDW Z Plant Sludge ^a (kg)
Radionuclide ^b	($\mu\text{Ci/g}$)	(Ci)
²³⁹ Pu	16.2	3,640
²⁴⁰ Pu	4.04	910
²⁴¹ Am	16.9	3,810
Density (g/mL)	1.72	NA

HDW = Hanford Defined Waste

^aAdjusted to 34.5 kgal of sludge

^bRadionuclides decayed to January 1, 1994.

D3.5 PREDICTED INVENTORY FOR TANK 241-TX-118

The chemical and radionuclide inventory of tank 241-TX-118 can be estimated from the T1 salt cake, T2 SltCk, and Z plant sludge volumes (23 kL [6 kgal], 984 kL [260gal], and 131 kL [34.5 kgal], respectively), densities (1.7, 1.7, and 1.72 g/mL, respectively), and the average of chemical/radionuclide concentrations calculated from T1 salt cake wastes, T2 SltCk wastes, and Z-Plant sludge wastes that have been analyzed or modeled. The resulting inventories are provided in Table D3-5. The inventories estimated by the HDW model (Agnew et al. 1997a) are included in the table for comparison.

Table D3-5. Estimated Chemical and Radionuclide Inventory for Tank 241-TX-118. (2 sheets)

Analyte	T1 salt cake layer (kg)	T2 salt cake layer (kg)	Z Plant layer (kg)	241-TX-118 inventory (kg)	HDW model inventory ^a (kg)
Ag	<0.513	21.9	NA	<22.4	NR
Al	67.7	46,100	38,800	84,900	62,200
Bi	15.0	<111	0	<126	235
Ca	9.67	498	2,160	2,670	3,150
Cd	<0.193	<12.1	NA	<12.3	NR
Cl	13.2	8,750	229	8,990	4,100
CO ₃	833	90,600	4,030	95,500	16,400
Cr	2.70	2,200	35.4	2,230	3,040
F	345	<3,220	0	<3,560	766
Fe	355	20,600	12,300	33,200	14,300
Hg	NR	NR	0	NA	0.966
K	<9.23	2,840	35.8	<2,890	1,150
La	<1.54	<57.2	0	<58.8	1.48
Mn	23.4	397	0	420	76.8
Na	8,370	353,000	5,910	367,000	152,000
Ni	<0.695	152	747	900	1,030
NO ₂	89.0	51,400	46.7	51,600	45,400
NO ₃	12,700	513,000	11,600	538,000	167,000
OH	247	55,000	85,600	141,000	165,000
Pb	16.1	<228	0	<244	96.1
P as PO ₄	4,950	12,800	0.964	17,800	7,110
Si	46.1	280	0	326	941
S as SO ₄	461	27,300	47.4	27,800	10,800
Sr	<0.610	<11.1	0	<11.7	0
TOC	NR	15,400	0	15,400	4,950
U	<21.0	<649	0	<670	1,420

Table D3-5. Estimated Chemical and Radionuclide Inventory for Tank 241-TX-118. (2 sheets)

Analyte	T1 salt cake layer (kg)	T2 salt cake layer (kg)	Z Plant layer (kg)	241-TX-118 inventory (kg)	HDW model inventory ^a (kg)
Zr	0.446	28.8	0	29.2	15.3
Radionuclide ^b (Ci)					
²⁴¹ Am	<4.75	<50,700	3,810	<54,500	4,330
¹⁴ C	NR	NR	NR	NR	13.8
⁶⁰ Co	<0.625	<237	NR	<238	15.3
⁹⁰ Sr	NR	NR	NR	NR	48,400
⁹⁰ Y	NR	NR	NR	NR	48,400
¹³⁴ Cs	0.31	1.61	NR	1.92	1.26
¹³⁷ Cs	102	186,000	NR	186,000	125,000
¹⁵⁴ Eu	<1.98	<835	NR	<837	252
¹⁵⁵ Eu	<1.94	<1,750	NR	<1,750	101
²³⁹ Pu	NR	NR	3,640	3,640	4,130
²⁴⁰ Pu	NR	NR	910	910	1,030

HDW = Hanford Defined Waste

NR = Not reported

^aAgnew et al. (1997a)^bRadionuclides decayed to January 1, 1994.

D3.6 COMPARISON OF TANK 241-TX-118 INVENTORY ESTIMATES

The lack of sample-based inventory data adds considerable uncertainty to estimates of chemical and radionuclide inventories for tank 241-TX-118. The use of waste composition data from tanks 241-T-108, 241-T-109, 241-U-102, 241-U-105, and 241-TX-116 to represent the wastes in tank 241-TX-118 salt cake is a reasonable approach in the absence of analytical data. Additionally, the composition of the Z Plant sludge layer is based entirely on the HDW model. It should be noted that the operating history of tank 241-TX-118 is different from any other Hanford tank containing similar waste types. Estimates based on compositions measured in other tanks or models should be regarded only as approximations.

The tank 241-TX-118 inventories predicted by the HDW model and the estimate based on waste analyses in other tanks are generally of the same order of magnitude, although the HDW is generally somewhat lower. Part of the explanation for this difference may be that

the HDW model calculated density for the 241-TX-118 T2 SltCk is 1.28 g/cc based on the sodium, aluminum, and hydroxide concentrations. This HDW calculated density is much lower than is generally found when salt cakes are analyzed. The calculated density is used in determining the HDW model inventory for all analytes.

Aluminum. The estimated aluminum inventory is 37 percent higher than that predicted by the HDW model. Most of this difference is due to the low T2 SltCk density calculated by the HDW model (1.28 g/cc), as compared to the 1.7 g/cc estimate based on the analytical results from tanks 241-U-102 and 241-U-105. Additionally, tank 241-TX-116 analytical results show a much higher aluminum concentration. Anderson (1990) indicates the processing of substantial volume of aluminum coating waste in the 1967-1968 time period. The estimated aluminum inventory will be used for the best-basis inventory.

Carbonate and Hydroxide. The estimated tank 241-TX-118 carbonate inventory is 5.8 times the HDW model inventory, whereas the estimated hydroxide inventory is only 85 percent of the HDW model prediction. The hydroxide ion in Hanford waste tanks is converted to carbonate by the absorption of carbon dioxide from the ambient air. The one mole of absorbed carbon dioxide will react with two moles of hydroxide ion to form one mole of carbonate ion. The rate is difficult to model at best and is accelerated by use of airlift circulators such as those installed in several TX tanks. Conversion of 44,800 kg of hydroxide to carbonate could account for the difference. The HDW model does not adequately account for the absorption of carbon dioxide from the atmosphere.

Fluorides. The estimated fluoride inventory is 4.6 times that predicted by the HDW model. This is likely the result of the HDW model assumptions that sodium fluoride is the only chemical compound containing fluoride and that it does not precipitate. The formation of insoluble fluoride compounds (such as sodium fluorophosphate) may be causing some fluoride to precipitate and remain in the tank.

Iron. The estimated iron inventory is skewed by the high iron concentrations (2.4 wt% on silicon-free basis) reported for tank 241-TX-116 T2 salt cakes. A later analysis of the tank 241-TX-116 salt cake (Schulz 1980) indicated very little insoluble material. The high iron concentration is not likely for a salt cake since iron is insoluble in alkaline solutions, and significant iron concentration would not be expected in the evaporator feed solutions, with the exception of iron included in the Z Plant acid wastes. Therefore, the HDW model iron inventory will be used for the best-basis.

Nitrate. The estimated nitrate inventory is 3.2 times that predicted by the HDW model. Most of the nitrate is associated with the T2 SltCk layer. The HDW model T2 SltCk inventory is predicted by the supernatant mixing model (SMM), and it is, therefore, difficult to determine the cause of this discrepancy. The global HDW model T2 SltCk concentration (see Table D3-2) is very reasonable, indicating that either the problem lies within the SMM model or that some feed inputs have been missed.

Sodium. The predicted HDW sodium inventory is about 41 percent that predicted from tank 241-TX-118 inventory. The T2 SltCk density calculated by the HDW model is 1.28 g/cc, which is about 25 percent below what is normally expected for a salt cake. The global HDW model T2 SltCk sodium concentrations is very reasonable (see Table D3-2). Either there is an internal problem in the SMM model calculations or some feed inputs have been missed.

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. In some cases, this approach requires other analyte (e.g., sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments, the number of significant figures is not increased. This charge balance approach is consistent with that used by Agnew et al. (1997a). The revised total hydroxide inventory based on sample analyses is 197,000 kg, which is a factor of 1.3 more than the HDW model estimate.

Cesium-137 and Strontium-90. The heat load for tank 241-TX-118 has been estimated at 4,789 BTU/h (Kummerer 1995). This corresponds to a maximum of 210,000 Ci ^{90}Sr (0.0228 BTU/hr/Ci ^{90}Sr) or a maximum of 297,000 Ci ^{137}Cs (0.0161 BTU/hr/Ci ^{137}Cs). About 63 percent of the heat load appears to be the result of ^{137}Cs based on the estimated ^{137}Cs inventory. The heat load contributed by ^{90}Sr and transuranic (TRU) elements is 2,125 BTU/hr based on the HDW model predictions for ^{90}Sr , ^{241}Am , and $^{239/240}\text{Pu}$. The combined best-basis ^{90}Sr , TRU, and ^{137}Cs inventories would produce 107 percent of the heat load estimated by Kummerer (1995), which is relatively good agreement.

Plutonium. The HDW model predicts that the tank 241-TX-118 plutonium inventory is 72.2 kg. Volume corrections for the Z Plant acid wastes would reduce this inventory to 59.4 kg of plutonium.

Other estimates of the tank 241-TX-118 plutonium inventory have been made. The Track Radioactive Components (TRAC) model (Jungfleish 1993) estimates the tank 241-TX-118 plutonium inventory to be 14.5 kg. Roetman et al. (1994) estimates only 8 kg of plutonium were included in the Z Plant acid waste transfers to the 242-T Evaporator, based on available Z Plant transfer sheets. These lower estimates are based on sample analyses at Z Plant, which, based on discussions with engineering personnel familiar with Z Plant operations, are strongly suspected to include only the plutonium associated with the supernatant.

The HDW model plutonium concentration of the Z Plant waste is based on sludge inventories for tank 241-SY-102. The HDW model plutonium concentrations for the Z Plant waste were used for calculation of the best-basis inventory since they are more conservative.

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D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage.

Chemical and radiological inventory information is generally derived using three approaches: (1) component inventories are estimated using the results of sample analyses, (2) component inventories are predicted using the HDW Model based on process knowledge and historical information, or (3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as the standard characterization for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for tank 241-TX-118 was performed including the following:

- Waste transactions and operating data to confirm that only 242-T Evaporator salt cakes and Z Plant waste are expected in tank 241-TX-118.
- Composition data from three waste tanks (241-T-108, 241-T-109, and 241-TX-116 [Baldwin et al. 1996, Brown et al. 1996, and Horton 1977]), which are expected to have a similar T1 salt cake compositions, and three waste tanks (241-U-102, 241-U-105, and 241-TX-116 [Hu et al. 1996, Brown and Franklin 1996, and Horton 1977]) that are expected to have similar T2 SltCk compositions.
- An inventory estimate generated by the HDW model (Agnew et al. 1997a)

Based on this evaluation, a best-basis inventory was developed. No recent analytical data are available for the salt cake remaining in tank 241-TX-118, because no core samples have been taken. The estimated inventory was, therefore, based on the composition of T1 salt cakes in tanks 241-T-108, 241-T-109 and 241-TX-116, and the composition of T2 salt cakes in tanks 241-U-102, 241-U-105, and 241-TX-116. The HDW model inventories were used when no other data were available or when analytical data were suspect.

The waste solid in tank 241-TX-118 is estimated to consist of 23 kL (6 kgal) of T1 salt cake, 984 kL (260 kgal) of T2 SltCk, and 131 kL (34.5 kgal) of Z Plant waste. The best-basis inventory for tank 241-TX-118 is presented in Tables D4-1 and D4-2. The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr , ^{137}Cs , $^{239/240}\text{Pu}$, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co , ^{99}Tc , ^{129}I , ^{154}Eu , ^{155}Eu , and ^{241}Am , etc., have been infrequently reported. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997, Section 6.1 and in Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks are reported in the HDW Rev. 4 model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. (No attempt has been made to ratio or normalize model results for all 46 radionuclides when values for measured radionuclides disagree with the model.) For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. 1997, Section 6.1.10.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-TX-118 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E or C) ¹	Comment
Al	84,900	E	
Bi	<126	E	
Ca	2,670	E	
Cl	8,990	E	
TIC as CO ₃	95,500	E	
Cr	2,230	E	
F	3,560	E	
Fe	14,300	M	
Hg	1.0	M	
K	<2,890	E	
La	<58.8	E	
Mn	420	E	
Na	367,000	E	
Ni	900	E	
NO ₂	51,600	E	
NO ₃	538,000	E	
OH _{TOTAL}	197,000	C	from charge balance
Pb	<244	E	
P as PO ₄	17,800	E	
Si	326	E	
S as SO ₄	27,800	E	
Sr	<11.7	E	
TOC	15,400	E	
U _{TOTAL}	<670	E	

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-TX-118 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E or C) ¹	Comment
Zr	29.2	E	

¹S = Sample-based

M = Hanford Defined Waste model-based, Agnew et al. (1997a)

E = Engineering assessment-based

C = Calculated by charge balance; includes oxides as hydroxides, not including CO₃, NO₂, NO₃, PO₄, SO₄, and SiO₃.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TX-118 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E) ¹	Comment
³ H	98.3	M	
¹⁴ C	13.8	M	
⁵⁹ Ni	0.982	M	
⁶⁰ Co	15.3	M	
⁶³ Ni	0.359	M	
⁷⁹ Se	1.43	M	
⁹⁰ Sr	48,400	M	
⁹⁰ Y	48,400	M	
⁹³ Zr	7.03	M	
^{93m} Nb	5.11	M	
⁹⁹ Tc	98.5	M	
¹⁰⁶ Ru	0.00279	M	
^{113m} Cd	36.6	M	
¹²⁵ Sb	65.7	M	
¹²⁶ Sn	2.17	M	
¹²⁹ I	0.190	M	
¹³⁴ Cs	1.92	E	
¹³⁷ Cs	186,000	E	
^{137m} Ba	176,000	E	
¹⁵¹ Sm	5,050	M	
¹⁵² Eu	1.70	M	
¹⁵⁴ Eu	2.52	M	
¹⁵⁵ Eu	101	M	
²²⁶ Ra	6.47 E-05	M	
²²⁷ Ac	4.12 E-04	M	
²²⁸ Ra	0.0771	M	
²²⁹ Th	0.00180	M	
²³¹ Pa	0.00185	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TX-118 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E) ¹	Comment
²³² Th	0.00486	M	
²³² U	0.393	M	
²³³ U	1.51	M	
²³⁴ U	0.510	M	
²³⁵ U	0.0211	M	
²³⁶ U	0.0134	M	
²³⁷ Np	0.359	M	
²³⁸ Pu	0.593	M	
²³⁸ U	0.581	M	
²³⁹ Pu	3,640	E/M	Based on reduced sludge volume of 34.5 kgal.
²⁴⁰ Pu	910	E/M	
²⁴¹ Am	3,810	E/M	
²⁴¹ Pu	39.5	M	
²⁴² Cm	0.0646	M	
²⁴² Pu	2.16 E-04	M	
²⁴³ Am	8.67 E-04	M	
²⁴³ Cm	0.00596	M	
²⁴⁴ Cm	0.0575	M	

¹S = Sample-based

M = Hanford Defined Waste model-based, Agnew et al. (1997a)

E = Engineering assessment-based.

D5.0 APPENDIX D REFERENCES

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